

Upgrade R&D WBS Dictionary

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4.1

**WBS
Number**

Description

4.1

Silicon

R&D and replacement for the silicon pixel and silicon strip systems, including off-detector electronics(RODs).

WBS Number	Description
4.1.1	Pixels R&D and replacements for the pixel detector
4.1.1.1	Replacement R&D Replacement R&D for the pixel system
4.1.1.1.1	Mechanics/Services Mechanical structure, power cabling, cooling. Comments: A low level of R&D to develop lower mass support and cooling structures. Design FY05 0.5 FTE ME FY06 1 FTE ME Tech FY05 0.25 FTE FY06 0.5 FTE Prototypes FY05 - FY06 25K/year
4.1.1.1.2	Sensors Sensor design, prototype fabrication and test

**WBS
Number****Description**

Comments: Design

FY05 0.5FTE EE
FY05 0.5 FTE EE

Fabrication
FY04 0
FY05 20K
FY06 20K

Test
Equipment
FY04 0
FY05 5K
FY06 10K

Labor
FY04 0
FY05 440 student hours
FY06 880 student hours

4.1.1.1.3**Electronics**

Electronics design, prototype fabricaton and test.

**WBS
Number****Description**

Comments: Design

Chip design in small feature-size technologies, evaluation of test results including after irradiation.

FY04 1.0 FTE EE

FY05 1.5FTE EE

FY06 2.0 FTE EE

Test system design

FY05 0.5

FY06 1.0

Fabrication(assumed shared with others)

IC runs

FY04 25K

FY05 50K

FY06 75K

Test systems

FY04 0

FY05 25K

FY06 25K

4.1.1.1.4**Hybrids**

Hybrid(or equivalent) design, prototype fabrication and test.

**WBS
Number****Description**

Comments: Design
FY04 0
FY05 0.25 EE
FY06 1.0 EE

Fabrication
FY04 0
FY05 20K
FY06 30K

Test
Equipment
FY04 0
FY05 5K
FY06 10K

Labor
FY04 0
FY05 440 hours technician
FY06 440 hours technician

4.1.1.1.5**Module assembly**

Module assembly design, prototype fabrication and test.

WBS
Number

Description

Comments: Design

This includes design for qualifying bump bonding vendors and for module assembly and test.

FY04 0

FY05 0.25 designer

FY06 0.5 designer

Fabrication

Bump bonding runs

FY04 0

FY05 25K

FY06 100K

Module assembly and test tooling, jigs

FY04 0

FY05 0

FY06 50K

Module assembly or test labor(includes testing bump bonding)

FY04 0

FY05 0

FY06 220 hours student

440 hours tech

4.1.1.1.6

Test beam support

Test beam operations for testing prototypes.

Comments: FY04 0

FY05 20K

FY06 20K

4.1.1.2

Replacement

Replacement of B-layer(at least) after first years of operation.

WBS Number	Description
4.1.1.2.1	Mechanics/Services Mechanical structure for new B-layer, insertion devices, new services Comments: Scaled from baseline cost estimate except for design.
4.1.1.2.2	Sensors Sensor final design, fabrication and test. Comments: Scaled from baseline cost estimate.
4.1.1.2.3	Electronics Electronics final design, fabrication and test Comments: Scaled from baseline cost estimate except for design.
4.1.1.2.4	Hybrids Hybrid final design, fabrication and test Comments: Scaled from the baseline cost estimate
4.1.1.2.5	Modules Module final design, assembly and test Comments: Scaled from the baseline cost estimate.

4.1.2

WBS Number	Description
4.1.2	SCT R&D and replacement of the silicon strip tracking system
4.1.2.1	Replacement R&D R&D leading to replacement of SCT system
4.1.2.1.1	Replacement R&D R&D related to replacement of the SCT and/or increased scope of silicon tracking within ATLAS. Comments: FY07-FY09, assuming replacement in FY14 and 5 year construction period.

4.1.3

WBS Number	Description
4.1.3	ReadOut Drivers R&D and replacements of the read-out driver(ROD) system.
4.1.3.1	Replacement R&D R&D related to replacing the ROD system for pixels and/or SCT. Comments: R&D just following first operational experience in FY06 and FY07.
4.1.3.2	Replacement - pixel RODs New RODs for B-layer or other replacement, FY08-FY09.